इंटरनेट मानक

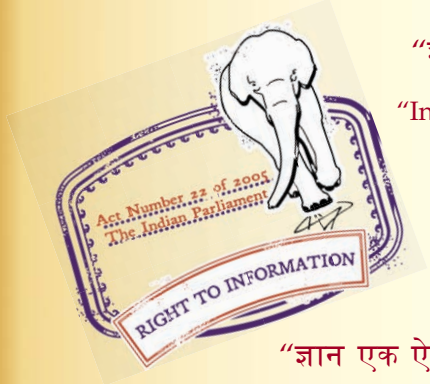
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 11396 (1985): Test methods for determination of storability (safe storage life) of foodgrains [FAD 16: Foodgrains, Starches and Ready to Eat Foods]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

IS : 11396 - 1985
(Reaffirmed 2005)

Indian Standard

TEST METHODS FOR DETERMINATION OF STORABILITY (SAFE STORAGE LIFE) OF FOODGRAINS

UDC 631·563 : 633·1 : 620·1

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3

March 1986

Indian Standard

TEST METHODS FOR DETERMINATION OF STORABILITY (SAFE STORAGE LIFE) OF FOODGRAINS

Storage Structures and Storage Management Sectional Committee, AFDC 28

Chairman	*Representing*
DR K. KRISHNAMURTHY	Department of Food (Ministry of Food & Civil Supplies), New Delhi
Members	
DR G. K. GIRISH (*Alternate* to Dr K. Krishnamurthy)	
DR R. A. AGARWAL	Indian Agricultural Research Institute (ICAR), New Delhi
DR T. D. YADAV (*Alternate*)	
AGRICULTURAL MARKETING ADVISER	Directorate of Marketing & Inspection, Ministry of Agriculture & Rural Development, Faridabad
SHRI A. P. BHATNAGAR (*Alternate*)	
DR A. ALAM	Indian Council of Agricultural Research, New Delhi
DR A. P. BHATNAGAR	Punjab Agricultural University, Ludhiana
CHIEF ENGINEER	Central Public Works Department, New Delhi
DR C. D. DWIVEDI	Defence Materials & Storage Research & Development Establishment, Kanpur
SHRI V. K. MATHUR (*Alternate*)	
BRIG V. N. KAPOOR	QMG's Branch, Army Headquarters (Ministry of Defence)
BRIG R. N. VARMA (*Alternate*)	
SHRI K. PANDITHURAI	Food Corporation of India, New Delhi
SHRI P. K. MOORJANI (*Alternate*)	
SHRI M. V. PAVATE	Planning Commission, New Delhi
SHRI RAMESH CHANDRA (*Alternate*)	
PLANT PROTECTION ADVISER	Directorate of Plant Protection, Quarantine & Storage, Faridabad
SHRI T. R. SHARMA (*Alternate*)	

(*Continued on page* 2)

(*Continued from page* 1)

Members	*Representing*
SHRI K. S. N. RAJU	National Co-operative Development Corporation, New Delhi
SHRI R. L. GAUR (*Alternate*)	
SHRI P. R. VISHWAMBHARAN	Central Warehousing Corporation, New Delhi
SHRI AJAY KHERA (*Alternate* I)	
SHRI P. P. MATHUR (*Alternate* II)	
SHRI T. PURNANANDAM, Director (Agri & Food)	Director General, ISI (*Ex-officio Member*)

Secretary
SHRIMATI SHASHI SAREEN
Deputy Director (Agri & Food), ISI

Grain Storage Data Subcommittee, AFDC 28 : 10

Convener

PROF A. P. BHATNAGAR	Punjab Agricultural University, Ludhiana

Members

PROF MALVINDER SINGH (*Alternate* to Prof A. P. Bhatnagar)	
PROF N. G. BHOLE	Indian Institute of Technology, Kharagpur
JOINT DIRECTOR (WS)	Planning Commission, New Delhi
SHRI K. V. S. MURTHY	Triveni Structurals Ltd, Naini
SHRI M. N. PAUL (*Alternate*)	
DR T. P. OJHA	Central Institute of Agricultural Engineering, Bhopal
SHRI K. PANDITHURAI	Food Corporation of India, New Delhi
SHRI P. K. MOORJANI (*Alternate*)	
SHRI K. T. RAMANATHAN	Larsen & Toubro Ltd, Bombay
SHRI K. V. GADEKAR (*Alternate*)	
SHRI M. V. SHARANGAPANI	Central Food Technological Research Institute, Mysore
DR B. P. N. SINGH	G. B. Pant University of Agriculture & Technology, Pantnagar
PROF C. K. TECKCHANDANI	J. N. Krishi Vishwa Vidyalya, Jabalpur
SHRI B. K. VERMA	Indian Grain Storage Research Institute, Hapur
SHRI S. R. AGARWAL (*Alternate*)	

Indian Standard

TEST METHODS FOR DETERMINATION OF STORABILITY (SAFE STORAGE LIFE) OF FOODGRAINS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 29 October 1985, after the draft finalized by the Storage Structures and Storage Management Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 A practical means by evaluating the conditions and storability of given lots of grains and seeds would be of great benefit to all those concerned with marketing, storage and processing of grains, seeds and their products.

0.3 A combination of tests involving moisture content, fat acidity, alcoholic acidity, temperature measurement, number and kinds of molds present, and viability should serve to predict storage behaviour and extent of actual damage. The moisture content and temperature measurement, indicate wheather there is present or future danger, fat acidity and alcoholic acidity give an indication of the actual damage which has already occurred, mold tests indicate whether invasion of the seed has already occurred, and viability whether incipient deterioration has developed.

---

1. SCOPE

1.1 This standard prescribes the test methods for determining the storability of foodgrains.

2. QUALITY OF REAGENTS

2.1 Unless specified otherwise, pure chemicals and distilled water (*see* IS : 1070-1977*) shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

*Specification for water for general laboratory use (*second revision*).

3. DETERMINATION OF MOISTURE

3.0 For details of the test method *see* IS : 4333 (Part 2)-1967*.

4. DETERMINATION OF FAT ACIDITY VALUE (FAV)

4.0 One of the causes of increase in (FAV) in stored grain is due to storage fungi. The enzyme lipase is associated with these fungi and is the cause of degradation of fat into fatty acids. Therefore, if increase in storage fungi is regularly accompanied by increase in FAV, measurement of FAV in a sample should be a quick way to judge relative storability. FAV may also be found without development of storage fungi, as during prolonged storage, fats are slowly converted to fatty acids in presence of the enzyme lipase and the free fatty acids give rise to FAV.

4.1 Apparatus

4.1.1 *Soxhlet Apparatus* — with a 250-ml flat-bottom flask.

4.2 Reagents

4.2.1 *Petroleum Ether* — boiling range 40 to 60°C.

4.2.2 *Benzene, Alcohol — Phenolphthalein Stock Solution* — To one litre of distilled benzene, and one litre of alcohol or rectified spirit and 0·4 g of phenolphthalein. Mix the contents well.

4.2.3 *Standard Potassium Hydroxide Solution* — 0·05 N.

4.3 Procedure — Grind the grains to pass through a 45-micron IS sieve. Weigh about 10 g of flour in a thimble and plug the top of the thimble with cotton. Extract fat in the Soxhlet apparatus for 6 hours and evaporate off the solvent in the flask on a water bath. Remove the traces of the residual solvent by keeping the flask in hot air oven at a temperature of 60° C for half an hour. Cool the flask and weigh a suitable quantity of extracted fat in a tared 250-ml flat bottomed flask and add 50 ml of mixed benzene-alcohol phenolphthalein reagent (**4.2.2**) and titrate the contents to a distinct pink colour with potassium hydroxide solution taken in a 10-ml microburette. Carry a blank determination on 50 ml reagent.

4.4 Calculation — Acidity of extracted fat (as oleic acid), percent by mass $= \frac{1{\cdot}41 \times (V - v)}{m}$

*Methods of analysis for foodgrains: Part 2 Moisture.

where

V = volume of 0·05 N potassium hydroxide solution used in titration of sample;

v = volume of 0·05 N potassium hydroxide solution used in blank; and

m = mass, in g of the fat taken for test.

5. DETERMINATION OF ALCOHOLIC ACIDITY

5.1 Reagents

5.1.1 *Neutral Ethyl Alcohol* — 90 percent (*v/v*).

5.1.2 *Standard Sodium Hydroxide Solution* — approximately 0·05 N.

5.1.3 *Phenolphthalein Indicator Solution* — Dilute 0·1 g of phenolphthalein in 100 ml of 60 percent (*v/v*) rectified spirit.

5.2 Procedure — Grind the grains to pass through a 45-micron IS sieve. Weigh about 5 g of sample into a conical stoppered flask and add 50 ml of neutral ethyl alcohol. Stopper, shake and allow to stand for 24 hours, with occasional shaking. Filter the alcoholic extract through a dry filter paper. Titrate the combined alcoholic extract against 0·05 N standard sodium hydroxide solution using phenolphthalein as indicator. Calculate the percentage of alcoholic acidity as sulphuric acid.

5.3 Calculation — Alcoholic acidity (as H_2SO_4) in 90 percent alcohol,

$$\text{percent by mass} = \frac{24{\cdot}52\,AN}{M}$$

where

A = volume in ml of standard sodium hydroxide solution used in titration;

N = normality of standard sodium hydroxide solution; and

M = mass in g of the material taken for the test.

6. MEASUREMENT OF TEMPERATURE

6.0 If insects or fungi are developing at or near their optimum rate in grain, each kind of insect or fungus will raise the temperature to about the maximum that it can endure. In the case of insects, about 40°C and in case of fungi about 55°C. Different methods for measurement of temperature in bulk grain are available. The thermocouple rope method is given below.

6.1 Instruments

6.1.1 *Thermocouple Cable* (*see* Fig. 1) — This consists of a plastic covered steel core about which are closely wound an insulated constantan thermocouple wire, and 9, 10 or 11 insulated copper thermocouple wires. The thermocouple wires are covered with polyvinyl chloride (PVC) to an outside diameter of 1·2 mm. Each thermocouple wire follows a helical path of about 2·5 cm pitch around the steel core. Thermocouple functions are formed at the required intervals along the cable during the winding process by parting the PVC insulation on the constantan wire and on an adjacent copper wire, twisting the two wires (including all of them not yet wound) one and a half turns and soft soldering the joint. When winding is continued, the constantan wire has crossed over the copper wire at the junction. The next function is formed between the constantan wire and the adjacent copper wire to which it has not yet been connected. Thus the constantan wire crosses over the copper wires in turn, making a thermocouple junction with each at a different depth. The uniform helical construction is maintained except where the insulation is pasted at the junction itself.

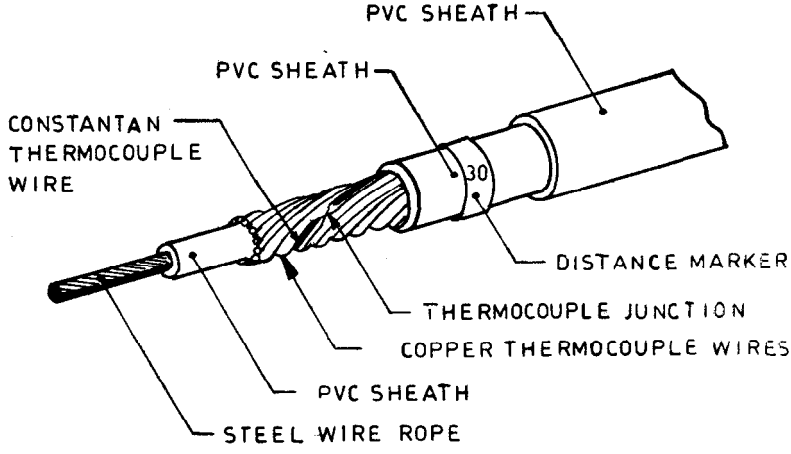


FIG. 1 THERMOCOUPLE CABLE

6.1.1.1 The thermocouple wires are protected and held in place by one or two thin plastic sheaths shrunk into place. Distances are marked along the cable using special PVC marking inks or by placing adhesive cable numbering strips under the outer clear sheath. The cable is terminated at one end in a brass plug carrying a transverse stainless steel pin, and at the other end in an aluminium bush; in each case the steel core, wires and covering are anchored into the fitting by an epoxyresin adhesive. The aluminium bush is clamped to a multicontact plug

which is used to connect the cable to the measuring instrument. The plug and receptacle are fitted with constantan contacts for the constantan wire in order to reduce errors resulting from temperature gradients which occur when a hot plug is connected to a cold receptacle or *vice versa*. Dust caps are fitted in order to keep the connector contacts clean.

6.1.1.2 *Potentiometer* — Any potentiometer capable of reading to an accuracy of plus or minus 4 microvolts is suitable.

6.2 Procedure — Insert themocouples into the grain by means of screwed chrome-plated steel rods to which they are attached by a special coupling. Push the rod, coupling and cable vertically down, slight tension being maintained on the cable to ensure that it does not slip from the coupling. Insert the cable to the required depth by adding rods one at a time and pushing them into the grain, the inserting clamp being used when hand pushing becomes difficult. As the cable has nine thermocouples at 60 cm intervals, the first cable is inserted to a depth of about 10 metres and a second is then inserted, in a similar manner to a depth of 5 metres. A delay, which will permit grain sampling to be carried out, is required before temperatures are read. After approximately 30 minute, connect the thermocouple cable in turn to the direct reading potentiometer. Measure each after a delay of two minutes or more which allows temperature gradients through the plug and receptacle to decay.

7. MICROBIOLOGICAL EVALUATION

7.0 Two methods for detection of presence of fungi namely the Agar plate method and the blotting paper method are given. A method for counting spores on grain surface is given in **7.4.**

7.1 Sampling — For microbiological examination, the sample should be handled asceptically and it should be truly representative of the lot. For this purpose IS : 5404-1969* shall be followed.

7.2 Agar Plate Method

7.2.1 *Reagents*

7.2.1.1 *Sodium hypochlorite solution* — 1 percent.

7.2.1.2 *Potato dextrose agar medium*

7.2.2 *Procedure* — From a representative grain sample separate 200 kernels and soak for 10 minutes in 25-ml of one percent sodium hypochlorite solution held in a 100-ml flask. Separate the kernels and wash in 100 ml sterile water and dry on a sheet of sterile paper. Sterilize

*Code of practice for handling of food samples for microbiological analysis.

the kernels once again in sodium hypochlorite solution for 5 minutes. Asceptically plate 100 kernels in a petri dish containing potato dextrose agar media. Incubate for 8 days at 20 ± 1°C under 12 hours dark-light cycle with near ultraviolet light (black light).

Examine under magnification, for presence and kind of fungi.

7.3 Blotting Paper Method

7.3.1 *Procedure* — From a representative grain sample separate 200 kernels. Place 100 kernels between two blotting papers of 15-cm diameter, placed inside a petri dish, each kernel being at a distance of 20 mm from each other. Incubate at 20 ± 1°C for 8 days. Examine the kernels for presence of fungi.

7.4 Counting Spores on Grain Surface — From a representative grain sample separate 200 kernels and shake in 25 ml of a solution of detergent or alcohol in a 100-ml flask. Decant the solution and examine 1 ml of solution under magnification and count the number of spores.

8. DETERMINATION OF VIABILITY

8.0 Viability is affected during storage due to effect of high moisture fungi and excessive biochemical activity. Tests on viability indicate general soundness of a grain lot. Viability is correlated with alcoholic acidity and free fat acidity.

8.0.1 Two methods for testing viability are given.

8.1 Method No. I

8.1.1 From a representative grain sample separate three hundred kernels. Plate 100 kernels at equal distances on a water soaked germination towel paper sheet (45 × 30 cm) placed on a butter paper of similar size. Cover this with another similar sheet. Roll all the sheets and place in a polyethylene envelope of 35 × 10 cm size. Keep these in an upright position in a germinator maintained at 20 to 30°C. Evaluate viability after 5 days and 10 days by counting kernels with emerged plumule and radicle. Carry out the test in triplicate and calculate the mean.

8.2 Method No. II

8.2.1 From a representative grain sample separate 300 kernels. Fit water-soaked filter papers on the top and bottom of a glass petri-dishes

of 15 cm diameter. Plate 100 kernels at equal distances on bottom of petri-dishes. Sprinkle excess water by means of a water bottle and incubate in a germinator maintained at 20 to 30°C. Evaluate viability after 5 days and 10 days, by counting kernels with emerged plumule and radicle. Carry out the test in triplicate and calculate the mean.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	$1\ N = 1\ kg.m/s^2$
Energy	joule	J	$1\ J = 1\ N.m$
Power	watt	W	$1\ W = 1\ J/s$
Flux	weber	Wb	$1\ Wb = 1\ V.s$
Flux density	tesla	T	$1\ T = 1\ Wb/m^2$
Frequency	hertz	Hz	$1\ Hz = 1\ c/s\ (s^{-1})$
Electric conductance	siemens	S	$1\ S = 1\ A/V$
Electromotive force	volt	V	$1\ V = 1\ W/A$
Pressure, stress	pascal	Pa	$1\ Pa = 1\ N/m^2$